IBIA Convention Cancun

What is Off Specification?

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IBIA Board Member

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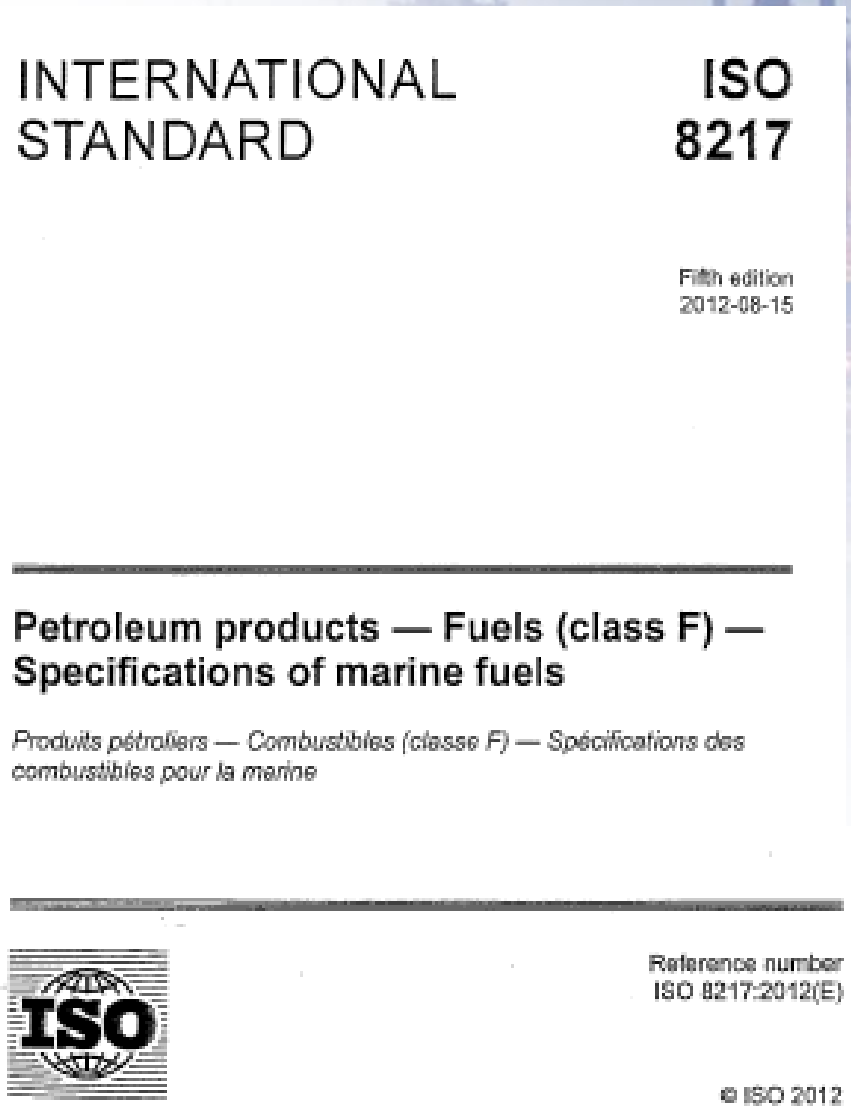
The Specification used in most commercial transactions



INTERNATIONAL STANDARD

ISO 8217

Fifth edition
2012-08-15

Petroleum products — Fuels (class F) — Specifications of marine fuels

Produits pétroliers — Combustibles (classe F) — Spécifications des combustibles pour la marine

ISO

Reference number
ISO 8217:2012(E)

ISO 8217 - What does ISO do ?

- ISO (International Organization for Standardization) is a worldwide network of the national standards bodies of 163 countries

- ISO is a non-governmental organization, which means that its members are not, as is the case in the United Nations system for example, delegations of national governments.

- International Standards give state of the art specifications for products, services and good practice, helping to make industry more efficient and effective. They make things work !

- ISO standards are developed through global consensus, they help to break down barriers to international trade.

What does ISO do ?

- ISO has no legal authority to enforce the implementation of standards
  - Some ISO standards - mainly those concerned with health, safety or the environment - have been adopted in some countries as part of their regulatory framework, or are referred to in legislation
- No transition period between publication and implementation
- The technical work of ISO is carried out through technical committees (TCs). Each technical committee may establish subcommittees (SCs) and working groups (WGs) to cover different aspects of its work.

ISO 8217 Specification of marine fuels

- Developed by ISO/TC 28/SC 4/WG 6
- **ISO 8217** – “Petroleum products – Fuels (class F) – specifications of marine fuels”
  - Internationally recognised standard to ensure quality of fuel meets customer requirements from point of manufacturing to point of custody transfer :
    - Engine performance: fuel has to be fit for purpose
    - Environmental performance: compliance meeting regulatory requirements
    - Ship safety and personnel health
- Specifies the requirements for petroleum fuels PRIOR to conventional on board treatment


INTERNATIONAL STANDARD

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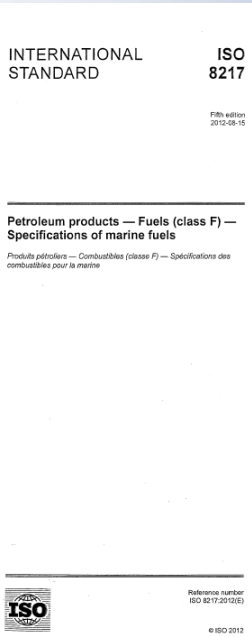
Reference number
ISO 8217:2012(E)

ISO 8217 Specification of marine fuels

- ISO 8217 is used in a commercial agreement between buyer and supplier and gains only legal standing when included in vessel charter party agreements and fuel purchasing contracts

- Adopting to the latest revision of the ISO 8217 offers improved quality control, better protection against engine damage, harmful emissions and safeguards the crew


INTERNATIONAL STANDARD

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Petroleum products — Fuels (class F) — Specifications of marine fuels

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ISO

Reference number
ISO 8217:2012(E)

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ISO 8217 Specification of marine fuels

- ISO/TC 28/SC 4/WG 6 aims to produce a sufficiently detailed, technically balanced and realistic standard

  – Experts, representatives of ship owners, ship operators, fuel testing services, engine and equipment manufacturers, fuel producers and suppliers, additive suppliers, classification societies, national standard bodies...

  – Considers :
    - Vessel's machinery developments including on board treatment limitations
    - Fuel oil production and global availability
    - Legislative requirements
    - Safety and health of ship and crew
    - Appropriate and scientifically valid test methods and specification limits

ISO 8217 Specification of marine fuels

BS MA 100:1982

- For the first time quality control to the customer
- Aimed to identify main fuel grades in the bunker market

1st edition ISO 8217:1987

- First ISO standard on marine fuel agreed worldwide
- Fuel quality guidance extended internationally

2nd edition ISO 8217:1996

- Better protection of fuel quality by introduction of catalytic fines control and stability assessment

3rd edition ISO 8217:2005

- Further improvement of fuel quality by introduction of protection from contaminants (ULO)

4th edition ISO 8217:2010

- Driven by request of IMO
- Significant improvement of marine fuel quality

5th edition ISO 8217:2012

- Minor revision to update on test method for H_2S


INTERNATIONAL STANDARD

ISO 8217

Petroleum products — Fuels (class F) — Specifications of marine fuels

2005 or 2010?

INTERNATIONAL STANDARD

ISO 8217

Third edition
2005-11-01

Petroleum products — Fuels (class F) — Specifications of marine fuels

Produits pétroliers — Combustibles (classe F) — Spécifications des combustibles pour la marine

Reference number
ISO 8217:2005(E)

© ISO 2005

MEPC 61/4/1
Annex, page 1

ANNEX

INTERNATIONAL STANDARD

ISO 8217

Fourth edition
2010-06-15

Petroleum products — Fuels (class F) — Specifications of marine fuels

Produits pétroliers — Combustibles (classe F) — Spécifications des combustibles pour la marine

Reference number
ISO 8217:2010(E)

© ISO 2010

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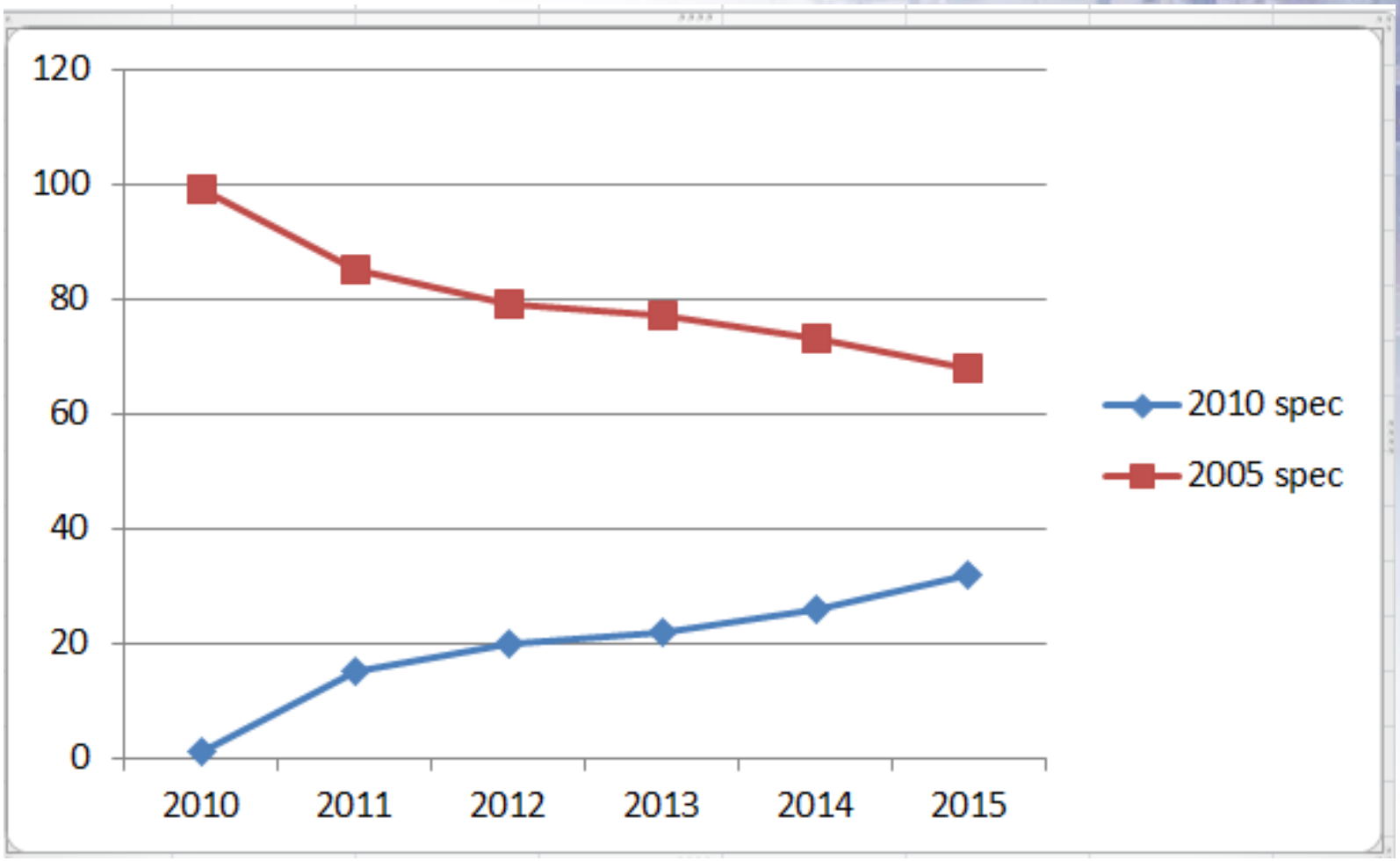
Continuous improvement.....

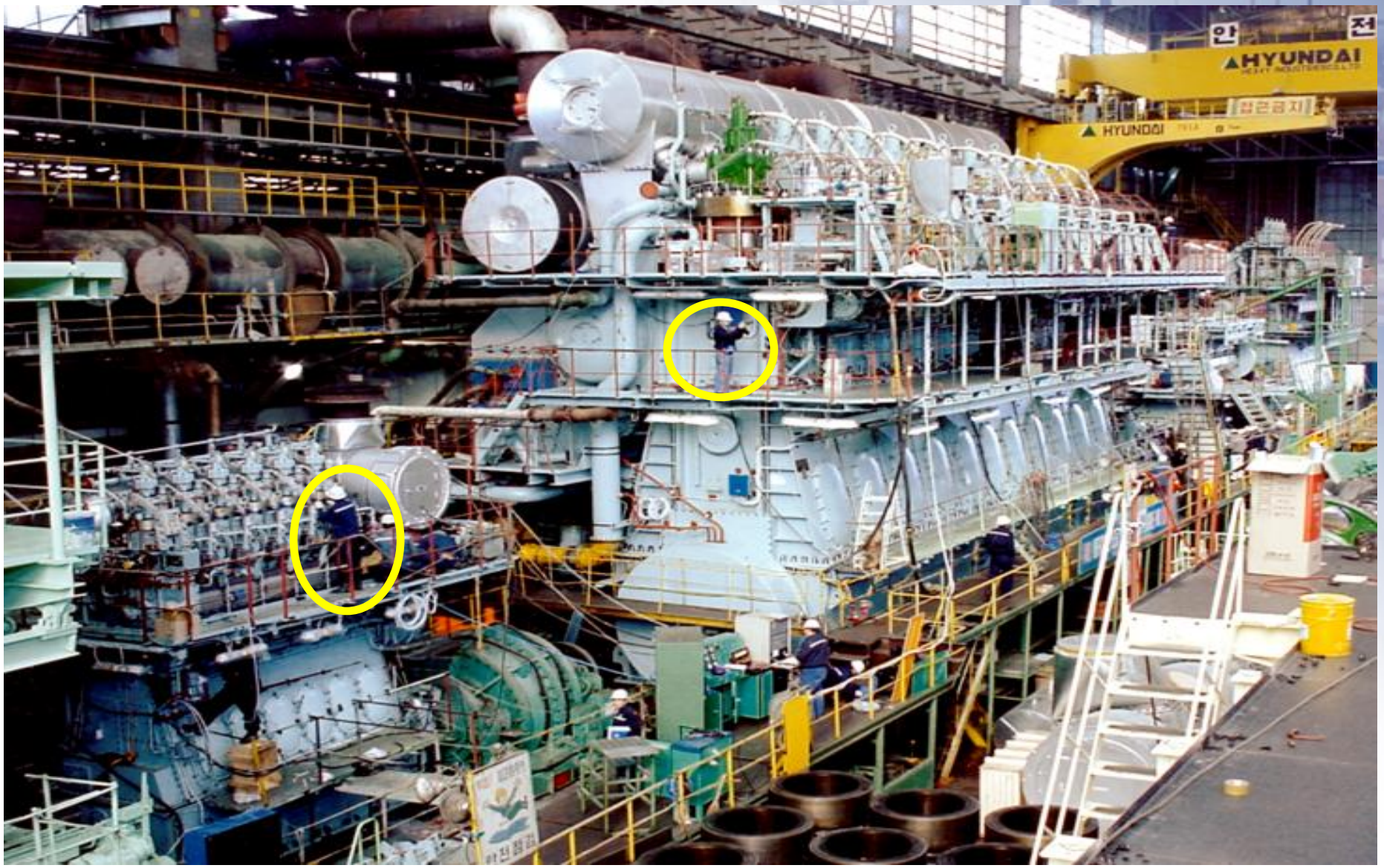
	ISO 8217:2005	ISO 8217:2010/2012
Acid number	Only strong acid number	Max limit introduced
Minimum viscosity distillate fuels	1.5 cSt min. - DMA only	All grades 2.000 cSt min. DMZ (3,000 cSt min) introduced
Oxidation stability	-	25 mg/kg max.
Lubricity limit	-	520 µm WSD max. when S below 500 mg/kg
H_2S	-	2 mg/kg max.
Al+ Si , residual fuels	80 mg/kg max.	RMG/RMK: 60 mg/kg max.
V	300 (RMG), 600 (RMK) mg/kg max.	350 (RMG), 450 (RMK) mg/kg max.
Sodium	-	RMG/RMK: 100 mg/kg max.
Ash content	RMG/RMK: 0,15 % mass max.	RMG: 0,100 mg/kg max. RMK: 0,150 mg/kg max.
Used Lubricating Oil	Ca<30 mg/kg Zn< 15 mg/kg P<15 mg/kg	Ca < 30 and Zn < 15 mg/kg Or Ca < 30 and P < 15 mg/kg
CCAI	-	RMG/RMK: 870 max.
		New or revised Annexes

Availability Vs Price?



WFS world wide statistics comparing uptake of ISO 2010 to ISO 2005 standard

How are the fuels used?



A 4,000 kW and an 85,000 kW engine

What can the engines handle?

Table 1 — Distillate marine fuels

Characteristic		Unit	Limit	Category ISO-F-				Test method reference
				DMX	DMA	DMZ	DMB	
Kinematic viscosity at 40 °C[a]		mm^2/s	max.	5,500	6,000	6,000	11,00	ISO 3104
			min.	1,400	2,000	3,000	2,000	
Density at 15 °C		kg/m^3	max.	—	890,0	890,0	900,0	see 7.1 ISO 3675 or ISO 12185
Cetane index		—	min.	45	40	40	35	ISO 4264
Sulfur[b]		mass %	max.	1,00	1,50	1,50	2,00	see 7.2 ISO 8754 ISO 14596
Flash point		°C	min.	43,0	60,0	60,0	60,0	see 7.3 ISO 2719
Hydrogen sulfide		mg/kg	max.	2,00	2,00	2,00	2,00	see 7.11 IP 570
Acid number		mg KOH/g	max.	0,5	0,5	0,5	0,5	ASTM D664
Total sediment by hot filtration		mass %	max.	—	—	—	0,10[d]	see 7.4 ISO 10307-1
Oxidation stability		g/m^3	max.	25	25	25	25[e]	ISO 12205
Carbon residue: micro method on the 10 % volume distillation residue		mass %	max.	0,30	0,30	0,30	—	ISO 10370
Carbon residue: micro method		mass %	max.	—	—	—	0,30	ISO 10370
Cloud point		°C	max.	–16	—	—	—	ISO 3015
Pour point (upper)[c]	winter quality	°C	max.	—	–6	–6	0	ISO 3016
	summer quality	°C	max.	—	0	0	6	ISO 3016
Appearance		—	—	Clear and bright[h]			d, e, f	see 7.6

[a] 1 mm^2/s = 1 cSt.

[b] Notwithstanding the limits given, the purchaser shall define the maximum sulfur content in accordance with relevant statutory limitations. See Annex C.

[c] Purchasers should ensure that this pour point is suitable for the equipment on board, especially if the ship operates in cold climates.

[d] If the sample is not clear and bright, the total sediment by hot filtration and water tests shall be required, see 7.4 and 7.6.

[e] If the sample is not clear and bright, the test cannot be undertaken and hence the oxidation stability limit shall not apply.

[f] If the sample is not clear and bright, the test cannot be undertaken and hence the lubricity limit shall not apply.

[g] This requirement is applicable to fuels with a sulfur content below 500 mg/kg (0,050 mass %).

[h] If the sample is dyed and not transparent, then the water limit and test method as given in 7.6 shall apply.

What can the engines handle?

Table 2 — Residual marine fuels

Characteristic		Unit	Limit	Category ISO-F-									Test method reference
				RMA	RMB	RMD	RME	RMG				RMK			
				10[a]	30	80	180	180	380	500	700	380	500	700	
Kinematic viscosity at 50 °C[b]		mm^2/s	max.	10,00	30,00	80,00	180,0	180,0	380,0	500,0	700,0	380,0	500,0	700,0	ISO 3104
Density at 15 °C		kg/m^3	max.	920,0	960,0	975,0	991,0	991,0				1010,0			see 7.1 ISO 3675 or ISO 12185
CCAI		—	max.	850	860	860	860	870				870			see 6.3 a)
Sulfur[c]		mass %	max.	Statutory requirements											see 7.2 ISO 8754 ISO 14596
Flash point		°C	min.	60,0	60,0	60,0	60,0	60,0				60,0			see 7.3 ISO 2719
Hydrogen sulfide		mg/kg	max.	2,00	2,00	2,00	2,00	2,00				2,00			see 7.11 IP 570
Acid number[d]		mg KOH/g	max.	2,5	2,5	2,5	2,5	2,5				2,5			ASTM D664
Total sediment aged		mass %	max.	0,10	0,10	0,10	0,10	0,10				0,10			see 7.5 ISO 10307-2
Carbon residue: micro method		mass %	max.	2,50	10,00	14,00	15,00	18,00				20,00			ISO 10370
Pour point (upper)[e]	winter quality	°C	max.	0	0	30	30	30				30			ISO 3016
	summer quality	°C	max.	6	6	30	30	30				30			ISO 3016
Water		volume %	max.	0,30	0,50	0,50	0,50	0,50				0,50			ISO 3733
Ash		mass %	max.	0,040	0,070	0,070	0,070	0,100				0,150			ISO 6245
Vanadium		mg/kg	max.	50	150	150	150	350				450			see 7.7 IP 501, IP 470 or ISO 14597

[a] This category is based on a previously defined distillate DMC category that was described in ISO 8217:2005, Table 1. ISO 8217:2005 has been withdrawn.

[b] 1 mm^2/s = 1cSt.

[c] The purchaser shall define the maximum sulfur content in accordance with relevant statutory limitations. See 0.3 and Annex C.

[d] See Annex H.

[e] Purchasers shall ensure that this pour point is suitable for the equipment on board, especially if the ship operates in cold climates.

There are many choices....

- Fuel <u>purchase</u> is at custody transfer
- Fuel <u>use</u> is at engine inlet
  - Responsibility to clean to attain OEM specifications

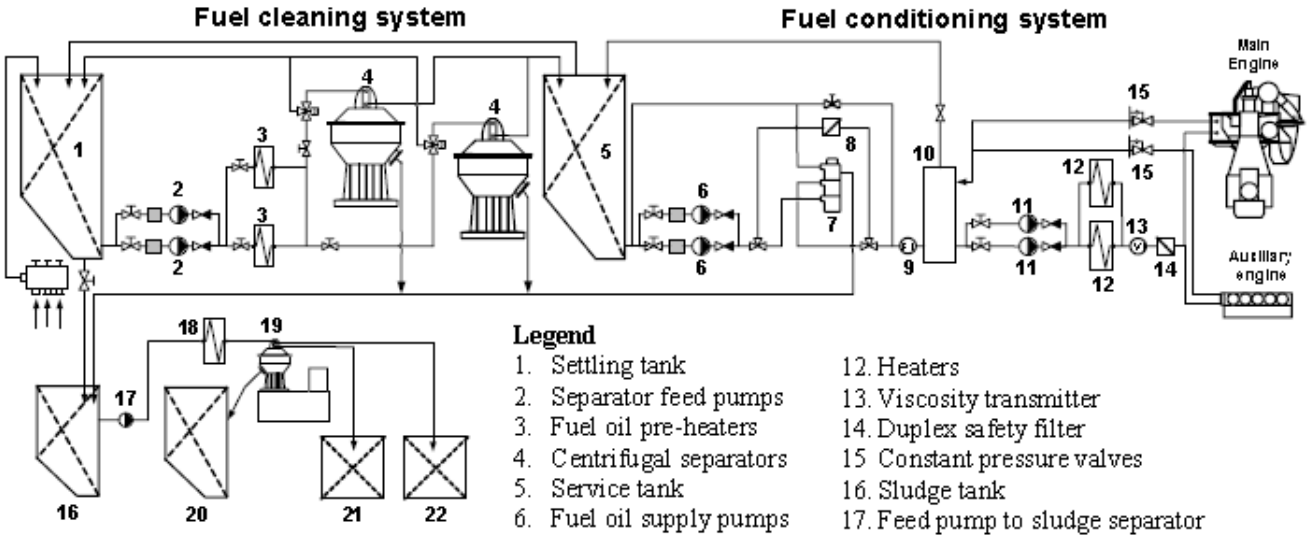


Figure 3:1. Fuel oil treatment system

CIMAC : recommedations concerning design of heavy fuel treatment plants for diesel engines

Fuel Testing : It's all about the measurement.....

- Measurement is not an exact science - this applies equally to fuel oil testing as to any other measurement activity.
- Consequently, there are factors, and combinations of factors, which influence a particular test result.
- In order to provide a controlled framework within which fuel oil testing is undertaken, analysis should be performed using standard test methods in a duly accredited laboratory.
- The accreditation of a laboratory within a national laboratory scheme covers its general competence, impartiality and performance capability.
- Typically this assessment will be against the requirements of ISO 17025 and will cover the principal test methods performed by the laboratory in question.

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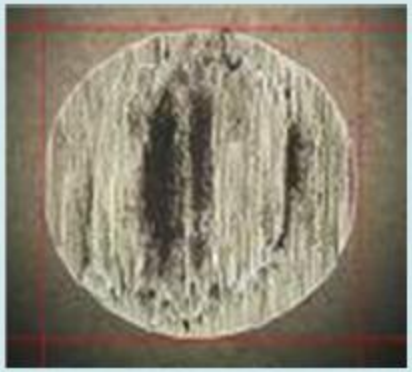

Fuel testing and analysis limitations

- The analysis results at best can only be as good as the sample the laboratory received.
- All laboratory tests include tolerance limits of repeatability / reproducibility. Minor variations between different laboratories must be expected.
- Test methods used do not simulate field conditions.
- Some laboratories unfamiliar with marine fuels may use incorrect test methods.
- Some fuels outside of specification when analysed may not give problems and conversely fuel within specification may give problems.

World Fuel Services

ISO 4259:2006 Petroleum products – Determination and application of precision of data in relation to methods of test


INTERNATIONAL STANDARD

ISO 4259

Third edition
2006-06-01

Petroleum products — Determination and application of precision data in relation to methods of test

Produits pétroliers — Détermination et application des valeurs de fidélité relatives aux méthodes d'essai

Reference number
ISO 4259:2006(E)

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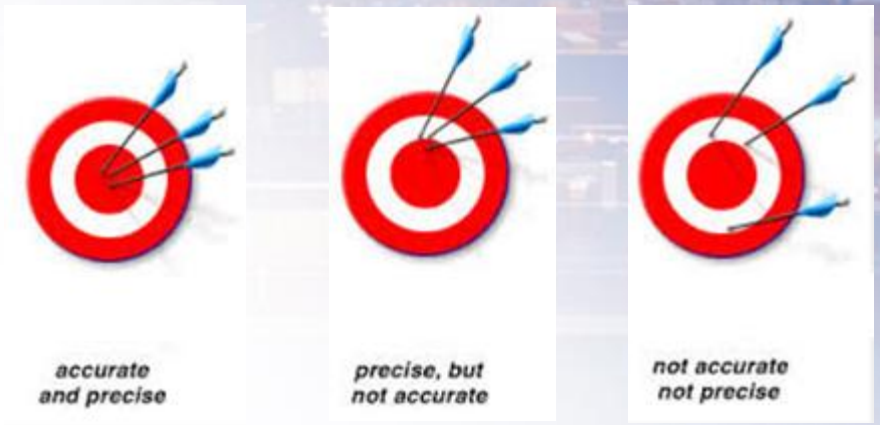
Are all fuel testing labs the same?



Which one would you want to use?

Which one gives a true value?

Test accuracy : ISO 4259

- For purposes of quality control and to check compliance with specifications, the properties of commercial petroleum products are assessed by standard laboratory test methods

- Two or more measurements of the same property of a specific sample by any given test method do not usually give exactly the same result

- It is therefore necessary to take proper account of this fact, by arriving at statistically-based estimates of the precision for a method,

- i.e. an objective measure of the degree of agreement to be expected between two or more results obtained in specified circumstances

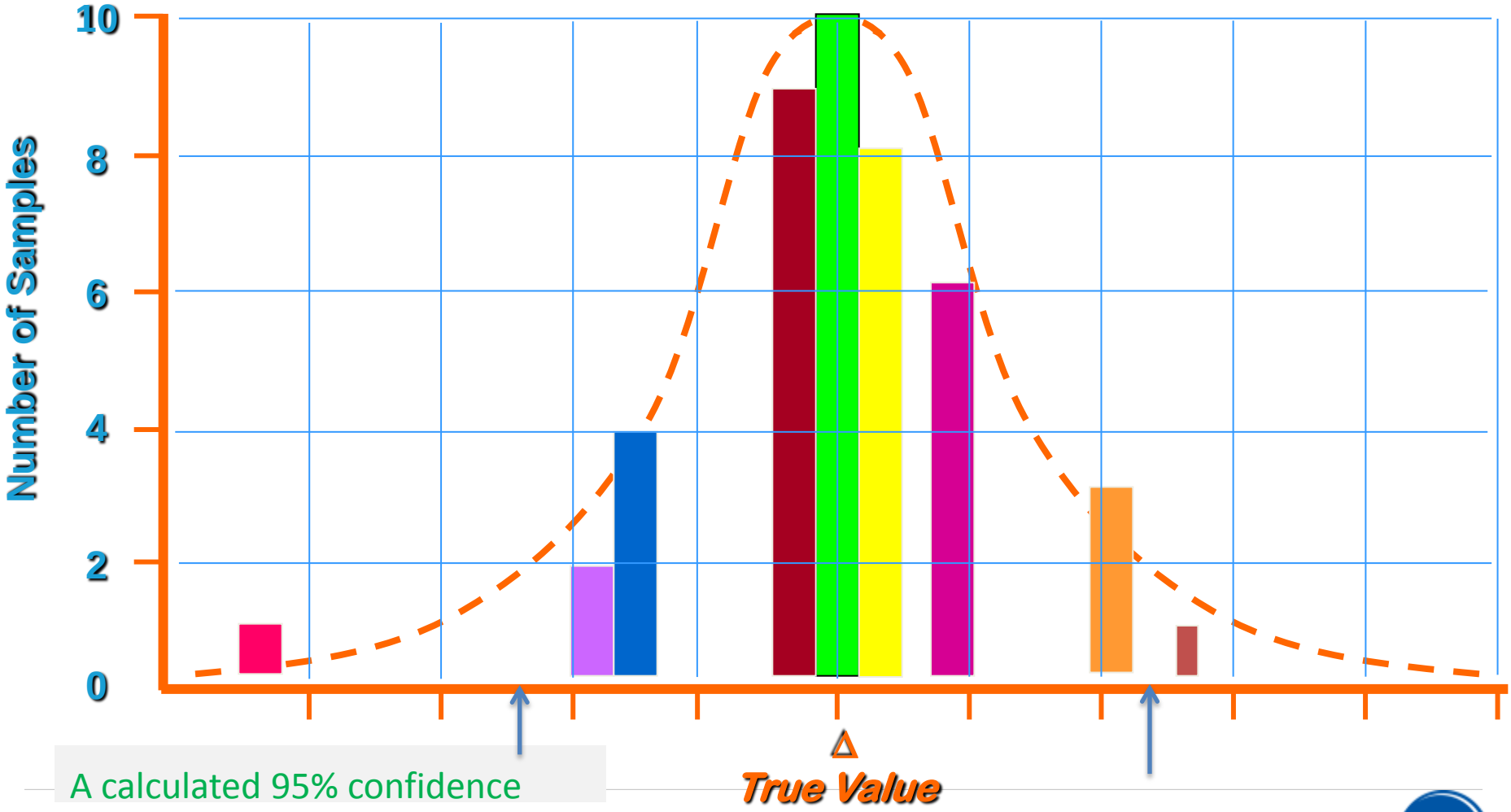
ISO 4259 : Introduces Definitions

- Test result - final value obtained by following the complete set of instructions in the test method
- True value - the average of single results obtained by *n* number of laboratories with *n* tending towards infinity
- Repeatability "r" – The variation in the test results on the same sample in the same lab with the same operator using the same apparatus and tests conducted within a short time interval to exclude time dependent errors
- Reproducibility "R" - The variation in the test results when tests are conducted on the same sample in different labs by different operators using different apparatus
- 95 % Confidence level – as 1 in 20 results can fall outside the limit
  - Defined as 0.59 x R

The (good) old days….

- Telex reporting
  - Max 80 characters per line
  - Fuel testing was born
    - No room for test methods/accuracy
    - Save money!
- Fast summary reporting
  - “cheap and nasty”
    - Methods/accuracy in the contract
      - Accuracy forgotten – BUT inherent in the methods

How is a test method set up?
"Round Robin" test



ISO 8217 – Specifications of marine fuels

INTERNATIONAL STANDARD **ISO 8217**

Petroleum products — Fuels (class F) — Specifications of marine fuels

Produits pétroliers — Combustibles (classe F) — Spécifications des combustibles pour la marine

8 Precision and interpretation of test results

The test methods specified in Tables 1 and 2 all contain a statement of precision (repeatability and reproducibility). The determination of reproducibility for CCAI is contained in Annex F.

ISO 4259:2006, which covers the use of precision data in the interpretation of test results, shall be used in cases of dispute. Information about precision and interpretation of test results is also given in Annex L.

Annex L : Complex Analysis and specifications

The true value, as defined by ISO 4259:2006, represents the average of an infinite number of single results obtained by an infinite number of laboratories. A fuel test, run a number of times at the same laboratory, by the same person, on the same sample, under the same conditions, might not necessarily yield exactly the same answer for each test run. These variations are quantified for each test method as repeatability, *r*. When two different laboratories test the same sample using the same method, the variation is called reproducibility, *R*.

No test method can measure the true value with 100 % certainty.

- The purpose of a specification is to fix a limit or limits to the true value of the property considered.
  - In practice, however, this true value can never be established exactly .
- The property is measured in the laboratory by applying a standard test method, the results of which may show some scattering as defined by the "repeatability" and "reproducibility".
- There is, therefore, always some uncertainty as to the true value of the tested property.

Annex L : Recipient : 95% confidence

L.3 Recipient with a single test result

A recipient who has no other information on the true value of a characteristic other than a single test result can consider that the product fails the specification limit, with 95 % confidence, only if the test result is such that

a) in the case of a maximum specification limit, the test result is greater than the specification limit plus $0{,}59 \times R$;

b) In the case of a minimum specification limit, the test result is less than the specification limit minus $0{,}59 \times R$.

EXAMPLE The recipient has ordered a fuel to ISO-F-RMG 380 specification in which

— the maximum specification limit is equal to 380 mm^2/s at 50 °C;

— the reproducibility, R, of the test method (ISO 3104) is equal to $0{,}074 \times 380$ mm^2/s at 50 °C.

Therefore, the recipient can consider that the product fails the specification, with 95 % confidence, if the single test result is greater than 396,59 mm^2/s at 50 °C.

«95% Confidence» is defined as 0.59 x Reproducibility
(NB : R changes by test method and test result)
Recipient must accept the confidence BEFORE sample can be seen to be off spec.

Annex L : Supplier : resolving disputes

L.4 Supplier with a single test result

A supplier who has no other information on the true value of a characteristic other than a single test result can consider that the product meets the specification limit, with 95 % confidence, only if the test result is such that

a) in the case of a maximum specification limit, the test result is less than or equal to the specification limit minus 0,59 × R;

b) in the case of a minimum specification limit the test result is greater than or equal to the specification limit plus 0,59 × R.

The use of the above equations is for the guidance of the supplier and should not be interpreted as an obligation. A reported value between the specification limit and the limit from L.4 a) or L.4 b) is not proof of non-compliance.

EXAMPLE The supplier has tested a fuel to ISO-F-RMG 380 specification in which

— the maximum specification limit is equal to 380 mm^2/s at 50 °C;

— the reproducibility, R, of the test method (ISO 3104) is equal to 0,074 × 380 mm^2/s at 50 °C.

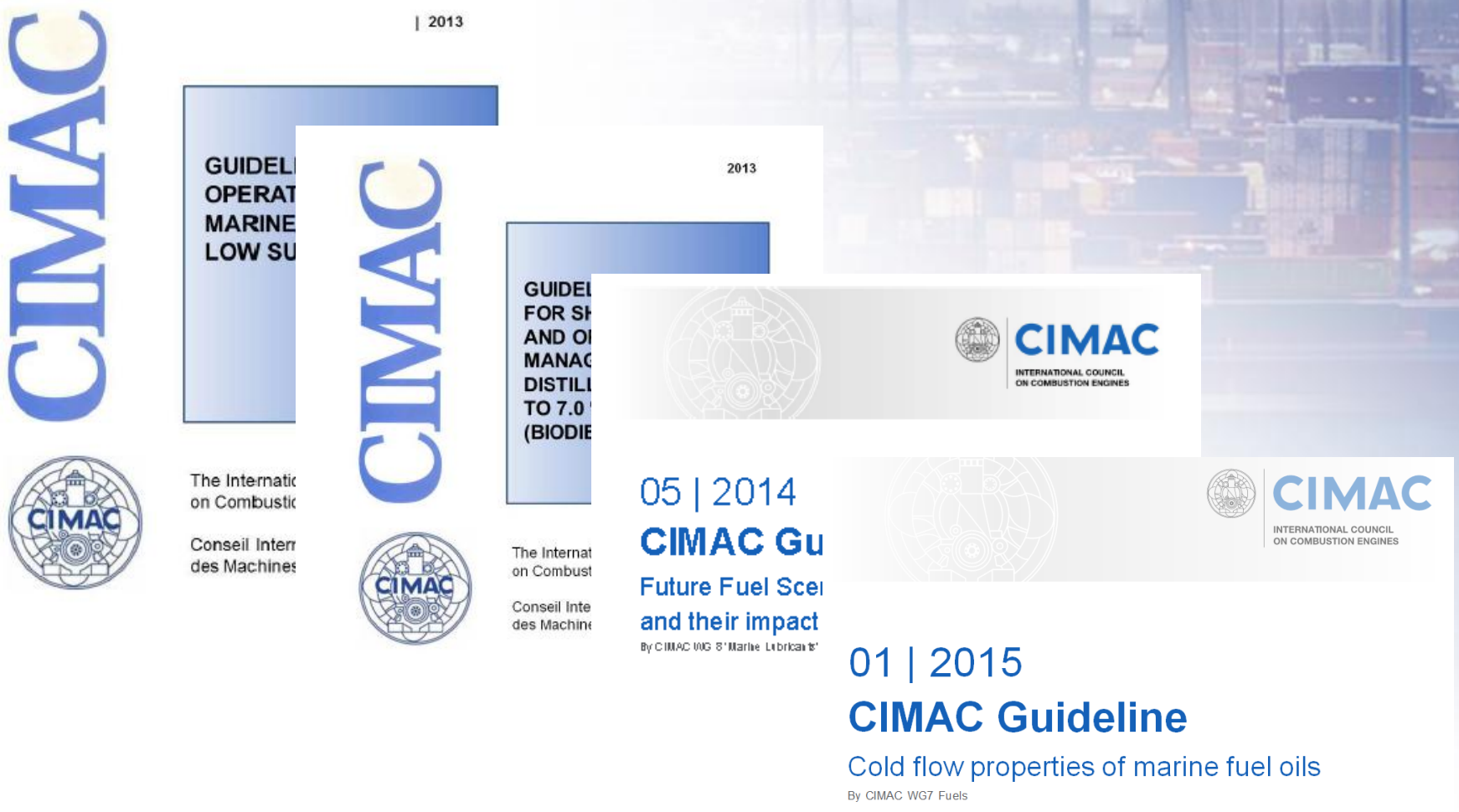
Therefore, the supplier can consider that the product meets the specification, with 95 % confidence, if the single test result is less than or equal to 363,41 mm^2/s at 50 °C.

Supplier has a repsonsibility to deliver to specification
He does NOT have the luxury of R when testing official samples

The industry turns to CIMAC

Individual Working Groups of experts (WG)

Projects & Activities



The Interpretation of Marine Fuel Oil Analysis Test Results with Particular Reference to Sulphur Content

- The CIMAC review highlights the differences between sulphur test results in accordance with ISO 8127 & ISO 4259, and MARPOL Annex VI.
- The issues between these different interpretations are identified and their impact and implications considered.
- It is further complicated by EC Sulphur Directive 2012/33/EU which has aligned itself with MARPOL Annex VI while stipulating a sulphur test method (ISO 8754) the precision of which was determined in accordance with ISO 4259

CIMAC
INTERNATIONAL COUNCIL
ON COMBUSTION ENGINES

09 | 2014

CIMAC Guideline

The Interpretation of Marine Fuel Oil Analysis Test Results with Particular Reference to Sulphur Content

By CIMAC WG7 'Fuels'

Based on ISO 4259 Chairman interpretation of bunkering with samples taken at either end of the hose and assuming they are the same sample – ie identical test material

The first edition of this CIMAC Guideline was approved by the members of the CIMAC WG 7 'Fuels' in July 2014.

14 CIMAC WG7 Fuels Working Group Membership

A.P. Moller Maersk
Alfa Laval
ANP
Bollfilter
BP Marine
Caterpillar Motoren
CEPSA
Chevron
Chevron Oronite
CMA-CGM
E.R. Schiffahrt
Exxon Mobil
GEA
Germanischer Lloyd
IMarEST
Infineum
Innospec Fuel Specialties
Intertek Lintec Shipcare Service
Lehmann & Michels
Lloyd's Register FOBAS
Maersk Maritime Technology
MAN Diesel and Turbo
Mitsubishi Machinery & Engine Group
Mitsui O.S.K. Lines
Nippon Yuka Kogyo
Petrobras
Shell Marine Products
Total, France
TransMontaigne
US Biodiesel Board
US Navy
VISWA Lab
VPS
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Review assumptions

- The CIMAC review takes the approach that each party has a single test result
    - In practice there may have been subsequent duplicate tests undertaken to validate the initial finding.
- Multiple test results act to reduce inter-test variability, but do not eradicate the previously mentioned naturally occurring differences.
- Assumption that all samples drawn from a fuel oil supply are identical and homogenous
- In reality testing may be carried out on samples drawn from different locations (storage, barge and vessel) which, while it does not preclude them being ‘identical’, can introduce result uncertainties.

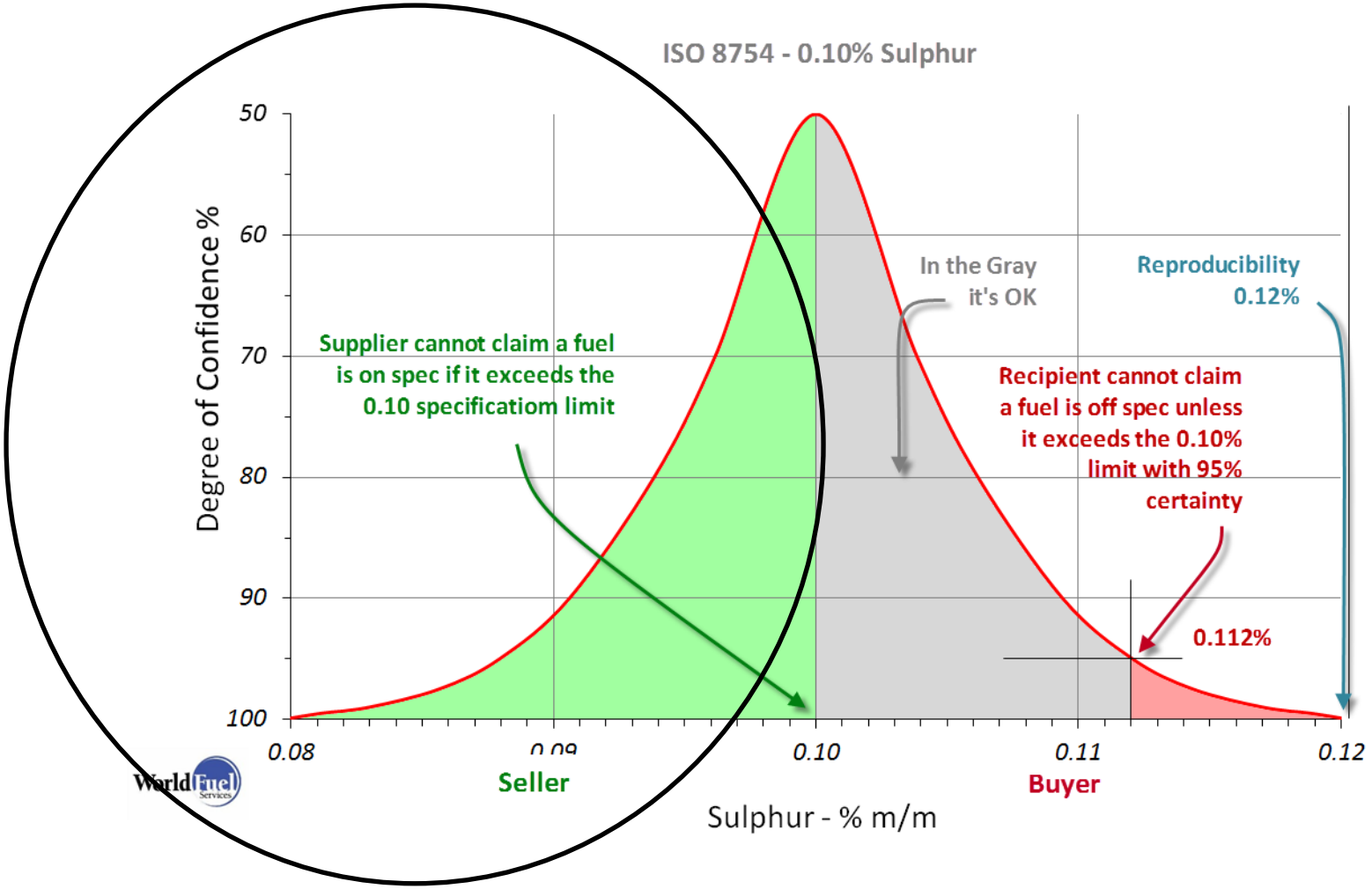
Sampling - Commercial Vs Statutory

There is a general misunderstanding that all samples, commercial and statutory MUST be taken at the same place.

- Of course, if possible, better to take ALL SAMPLES at one location
- <u>Commercial samples</u>
  - Local conditions apply according supplier T&C
    - Commercial samples usually taken at barge
    - Except Singapore
    - SS 600
    - Vessel manifold sampling
- It is the COMMERCIAL sample that applies if a commercial claims
- <u>So-called MARPOL sample</u>
  - MARPOL Guideline 182/59
    - Recommends sampling at the vessel manifold
      - A recommendation, not a law
  - MARPOL Annex Vi says that the supplier is responsible to deliver a represetative sample
    - Retined onboard for minimum one year – or until the fuel is consumed, if longer
  - So far, MARPOL samples have never been tested
  - The MARPOL sample applies ONLY to the statutary regulations

As per ISO 4259 interpretation, the vessel sample is for information only and a first step, with official T&C sample to be tested jointly, for dispute parameters if vessel sample is outside 95% confidence.

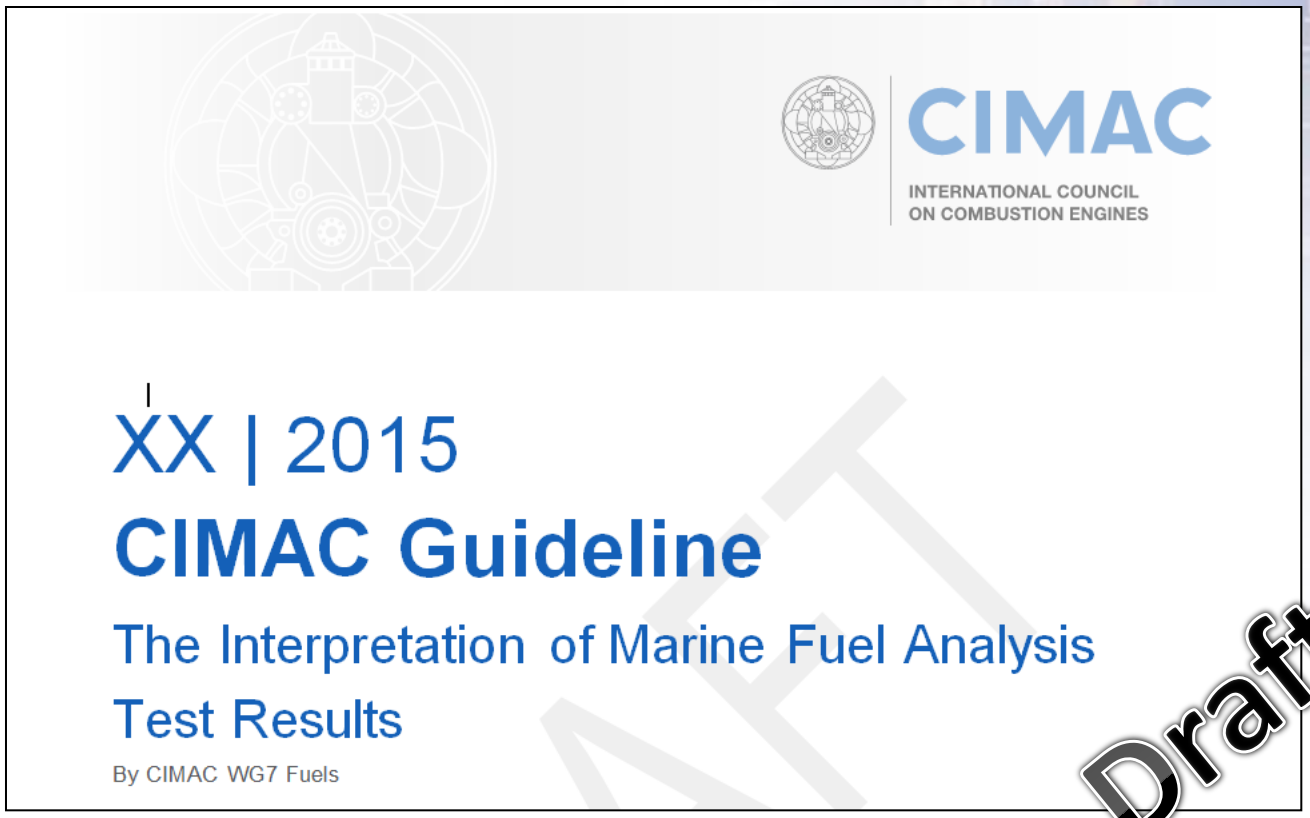
The complete picture



Applies to all test methods, not only sulphur

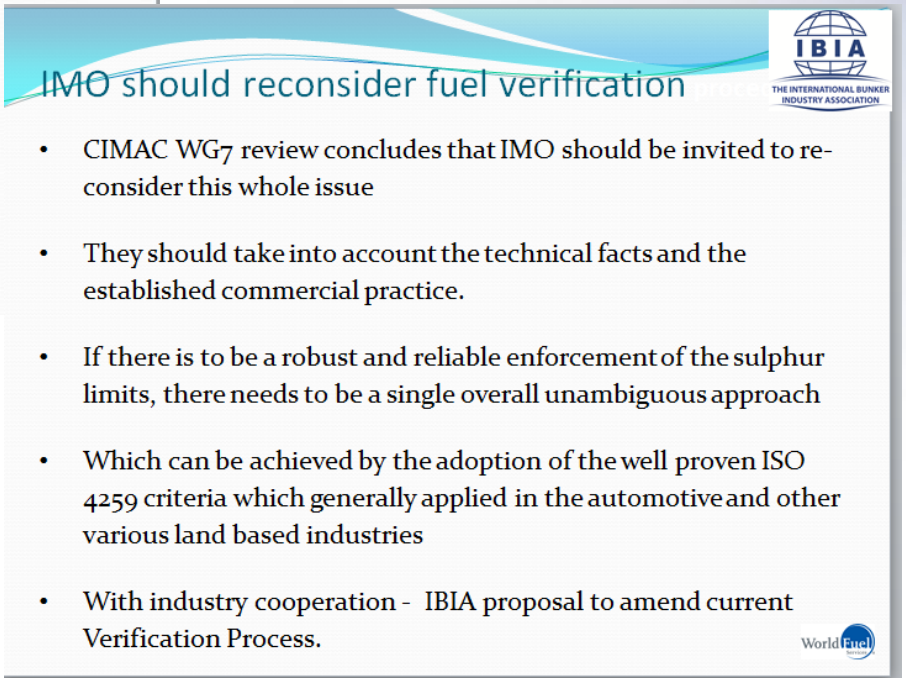
Not only sulphur – all parameters – coming soon

Commercially, CIMAC recommendation :



IBIA proposal to IMO – ISO/CIMAC principles

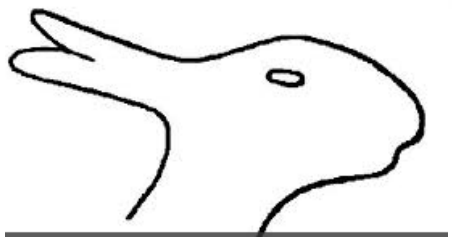
Statutory samples, CIMAC recommendation :



Summary

- What specification is chosen in a bunker purchase?
  - Why?
- How does ordered specification compare to optimum quality for the engine?
  - Cleaning system, engine type, separator type...
- Where was the sampling done and which sample was tested?
  - Statutorery vs commercial
  - MEPC 182/59 Vs ISO 13739
- We must use industry accepted commercial practise to compare to the specification.
  - On or off spec? If it's in the Grey, it's ok
- Crew competence is paramount to use fuel as delivered
  - Responsibility to clean before use
- IMO Verification process Vs Commercial test uncertainty
  - Standardise the industry
  - IBIA focus
    - Get involved!
- IF off specification, how do we handle the process?
  - Mitigation
  - As we have always done
  - BUT with agreed industry accepted outcome

IBIA
THE INTERNATIONAL BUNKER INDUSTRY ASSOCIATION



THANK YOU

Questions?

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